14. The thermal management system of claim 4 which further comprises a heat source comprising an electronic component having an external surface, wherein one of the planar surfaces of the thermal interface is in direct operative contact with the external surface of the heat source and the second of the planar surfaces of the thermal interface is in direct operative contact with the heat collection surface of the heat sink.

MARKED UP CLAIMS TO SHOW CHANGES

1. (Amended) A thermal management system comprising a heat source having an external surface and a thermal interface which comprises an anisotropic flexible graphite sheet formed by compressing exfoliated particles of natural graphite and having a planar area greater than the area of the external surface of the heat source, the flexible graphite sheet [thermal interface] being in direct operative contact [connection] with the heat source.

4. (Amended) A thermal management system comprising a heat sink which comprises a graphite article shaped so as to provide a heat collection surface and at least one heat dissipation surface, and said system further comprising a thermal interface operatively connected to the heat sink, the thermal interface comprising

an anisotropic flexible graphite sheet having two parallel planar surfaces extending in a direction parallel to the planar direction of the crystal structure of the graphite in the sheet, wherein arranging the heat collection surface of the graphite article in direct operative [connection] contact with one of said planar surfaces and arranging the other of said planar surfaces in direct operative contact with a heat source causes dissipation of heat from the heat source through the at least one heat dissipation surface of the graphite article.

14. (Amended) The thermal management system of claim [13] 4 which further comprises a heat source comprising an electronic component having an external surface, wherein one of the planar surfaces of the thermal interface is in direct operative contact [connection] with the external surface of the heat source and the second of the planar surfaces of the thermal interface is in direct operative contact [connection] with the heat collection surface of the heat sink.

COMMENTS

PARAGRAPH 2 OF THE OFFICE ACTION

In paragraph 2 of the Office Action the Examiner has rejected claims 1-4, 7, 8, 11, 13-15 and 18-21 under 35 U.S.C. 102 based upon U.S. Patent No. 4,878,152 to Sauzade *et al.* That rejection, as applied to the amended and remaining claims, is respectfully traversed for the following reasons.

Each of the independent claims 1, 4 and 15, now includes several concepts, which as explained below, clearly distinguish them from Sauzade.

The claims (as amended in the case of claims 1 and 4, and as originally submitted in the case of claim 15) are each directed to a thermal interface which includes a "flexible graphite sheet". Furthermore, this flexible graphite sheet is required to be in "direct operative contact" with the heat source. Thus in the present invention the flexible graphite sheet is the actual thermal interface with the heat source, and with a heat sink if the heat sink is included in the claims, and thus facilitates heat transfer between the two. The flexible nature of the "flexible graphite sheet" permits it to conform to the surfaces of the heat source and heat sink and make that intimate contact. See page 11 line 23-page 12 line 10 of the present application.

This is in sharp contrast to the system disclosed in Sauzade *et al.* U.S. Patent No. 4,878,152. The graphite sheet utilized by Sauzade is described at col. 2, l. 34 thereof as "relatively brittle". It is specifically not comprised of "flexible graphite sheets" as set forth in the present invention. In the Sauzade system, "Since this layer (the graphite layer) is relatively brittle, it is sandwiched between two thinner layers with a high modulus and a very low expansion coefficient, consisting of stratified sheets of carbon fibers embedded in a binder such as epoxy resin. To complement the mechanical strength of the unit, it is held in a metallic frame which has little expansion." (Sauzade, col. 2, l. 34-40)

Thus Sauzade does not show or suggest a "flexible graphite sheet", or one which is in "direct operative contact" with the heat source.

PARAGRAPH 3 OF THE OFFICE ACTION

In paragraph 3 of the Office Action the Examiner has rejected claim 4 under 35 U.S.C. 102 based upon U.S. Patent No. 6,208,513 to Fitch *et al.*

As noted, claim 4 has been amended. Claim 4 now requires that there be both a graphite heat sink and a thermal interface. The thermal interface must be constructed from an "anisotropic flexible graphite sheet having two parallel planar surfaces", and one of those planar surfaces must be in "direct operative contact" with the heat source and the other must be in "direct operative contact" with the heat collection surface of the heat sink. Thus, heat is transferred from the heat source through the thermal interface to the heat collection surface of the heat sink, and is further conveyed through the heat sink to the heat dissipation surface of the heat sink where the heat is dissipated. No such structure is in any way shown or suggested by Fitch. The only graphite structure shown in Fitch is a plurality of fins which are described as nothing more than possibly being of graphite material. There is no disclosure that they should be of a flexible graphite material. There is no graphite "thermal interface". In short, Fitch *et al.* is of very little relevance to claim 4 as amended.

PARAGRAPH 4 OF THE OFFICE ACTION

In paragraph 4 of the Office Action the Examiner has rejected claims 4 and 5 under 35 U.S.C. 102(e) based upon U.S. Patent No. 6,027,807 to Inoue *et al.*

The present language of claim 4 as amended has just been discussed above. Inoue *et al.* also falls far short of showing or suggesting the structure of amended claim 4. The Inoue patent describes a flexible graphite sheet that is clad with a "supporting element" that may be made from a "metal sheet...metal lathe...ceramics, resins, clothes and papers" (see col. 14, l. 36-46). Multilayered clad material can then be folded in an accordion-like fashion as shown in Fig. 11 thereof to form a heat sink.

But the heat sink of Fig. 11 of Inoue *et al.* clearly does not meet the requirements of claim 4. The lowermost surface of the heat sink of Fig. 11 is formed from the aluminum mesh reinforcing layer 12, and thus there is not a flexible graphite sheet that would be in "direct operative contact" with a heat source. Furthermore there is no thermal interface shown in Inoue *et al.* separate from the heat sink.

PARAGRAPH 5 OF THE OFFICE ACTION

In paragraph 5 of the Office Action the Examiner has rejected claims 4 and 6 under 35 U.S.C. 102(e) based upon U.S. Patent No. 6,131,651 to Richey.

Richey also falls far short of disclosing the system of amended claim 4. The heat transfer device described by Richey comprises a "core material consisting of pyrolytic graphite or highly ordered pyrolytic graphite" and "a pair of flexible face sheets of metallic composition...disposed upon opposing surfaces of said core material to form a sandwich construction...enclosing and sealing said core material within" (col. 4, l. 20-34 of Richey). Thus, the graphite core material of Richey is isolated from the heat source by the metallic face sheets and is not in "direct operative contact" with the

heat source. Furthermore, Richey does not disclose a separate heat sink associated with the thermal interface.

Furthermore, the "holes" of Richey to which the Examiner has referred are entirely different from the "holes" mentioned in claim 6 of the present application. The "holes" of claim 6 are structural features which provide a heat dissipation surface. The "holes" of Richey, on the other hand, are intended to be filled with a structural material to connect the face sheets together mechanically. Clearly the "holes" of Richey are in no way relevant to the "holes" of claim 6.

PARAGRAPH 7 OF THE OFFICE ACTION

In paragraph 7 of the Office Action the Examiner has rejected claims 5, 6, 9, 10, 12, 16, 17 and 22 under 35 U.S.C. 103 based upon Sauzade *et al.* in view of Richey.

As previously noted the primary reference to Sauzade does not show or suggest the invention of either amended claim 4 or original claim 15 from which all of the claims in question depend. There is far more missing from Sauzade with regard to parent claims 4 and 15 other than simply the use of fins.

The Examiner has cited Richey for showing of fins, but Richey in no way supplies the other missing elements of the parent claims for all the reasons discussed above.

The Examiner further cites Richey with regard to its showing of "holes" such as called for in dependent claim 6, but as already discussed above, the "holes" in Richey are totally dissimilar in purpose and function from those of claim 6.

Accordingly, it is respectfully submitted that all of the claims in question are clearly allowable over the cited references.

PARAGRAPH 8 OF THE OFFICE ACTION

In paragraph 8 of the Office Action the Examiner has rejected claims 1-3, 7-15 and 17-22 under 35 U.S.C. 103 based upon U.S. Patent No. 6,027,807 to Inoue *et al.* in view of U.S. Patent No. 4,878,152 to Sauzade *et al.*

With regard to amended independent claim 1, the primary reference to Inoue *et al.* falls short of teaching the claimed invention in that Inoue *et al.* does not teach the use of a flexible graphite sheet in "direct operative contact" with a heat source. As previously noted, in the embodiment of Fig. 11 of Inoue *et al.* it is the aluminum plate 12 which in fact defines the bottom surface of the heat sink shown in Fig. 11 of Inoue *et al.*

With regard to independent claim 4, claim 4 is distinguished from Inoue *et al.* for all the reasons previously discussed with regard to paragraph 4 of the Office Action.)

With regard to independent claim 15, Inoue *et al.* is still further deficient. Claim 15 requires both a thermal interface made of a flexible graphite sheet and a heat sink made of graphite. The thermal interface is required to be in operative contact with the heat source, and a heat collection surface of the heat sink is required to be in operative contact with the thermal interface. No such structure is in any way

shown or suggested by Inoue *et al.* Inoue *et al.* does not provide a separate thermal interface made of a flexible graphite sheet.

These deficiencies of Inoue *et al.* are not supplied by Sauzade for reasons discussed above.

Accordingly, it is respectfully submitted that independent claims 1, 4 and 17 and all those claims dependent therefrom are allowable for the reasons set forth.

PARAGRAPH 9 OF THE OFFICE ACTION

In paragraph 9 of the Office Action the Examiner has rejected claims 1-3, 7-12, 15 and 17-22 under 35 U.S.C. 103 based upon U.S. Patent No. 6,131,651 to Richey in view of U.S. Patent No. 4,878,152 to Sauzade *et al.* That rejection is respectfully traversed for the following reasons.

As previously noted, with regard to paragraph 5 of the Office Action, Richey falls far short of showing or suggesting the concepts of the present invention. Richey is directed to a "core material consisting of pyrolytic graphite or highly ordered pyrolytic graphite" and "a pair of flexible face sheets of metallic composition...disposed upon opposing surfaces of said core material to form a sandwich construction...enclosing and sealing said core material within". Thus the graphite material of Richey is not in direct operative contact with either a heat source or a heat sink. None of these shortcomings are in any way taught by Sauzade which is similarly deficient.

CONCLUSION

In summary, it is believed that the arguments and amendments set forth above are sound, and accordingly reconsideration of the application is requested along with an early indication of the allowance of claim 1-2, 4-12 and 14-22.

Respectfully submitted,

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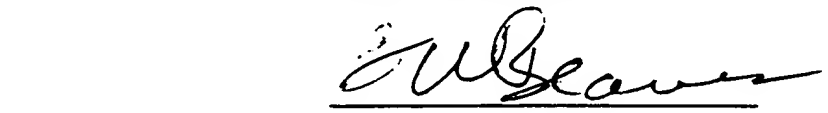

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